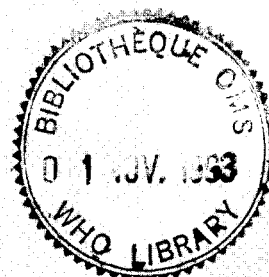


# Poliomyelitis

**A Guide for Clinicians**



produced by  
The Expanded Programme on Immunization  
The World Health Organization  
1993



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# PART 1.

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This booklet is a briefing for physicians on poliomyelitis. It is produced by the World Health Organization to both update physicians' knowledge of poliomyelitis and to request their support for the worldwide effort to eradicate the disease. It provides a review of medical knowledge about poliomyelitis and polio immunization as well as an overview of the poliomyelitis eradication initiative. It also indicates ways that physicians can support the initiative. Although much of the work of polio eradication will be carried out by Ministries of Health with the support of the World Health Organization, Rotary International, UNICEF and other international organizations, clinicians – physicians who treat patients – must be involved if the initiative is to succeed.

We hope that this booklet will stimulate your interest in poliomyelitis. We encourage you to become involved in the poliomyelitis eradication initiative. You can become involved in many ways: by increasing your knowledge of poliomyelitis, keeping the disease in mind when treating any case of sudden paralysis and diagnosing poliomyelitis when it occurs in your patients; by reporting suspected poliomyelitis cases immediately to your local health authorities; by immunizing children with oral polio vaccine (OPV); by ensuring that vaccines given in your clinic or hospital are fully potent; by informing your fellow physicians about the poliomyelitis eradication initiative; or by serving on expert committees to review poliomyelitis cases. Please read this booklet, talk about it with your colleagues, and think about how you can support the poliomyelitis eradication effort. Then, get involved.

We appreciate the help you can give.

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# **PART 2.**

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## **Introduction**

In 1988, the World Health Organization committed itself to the eradication of poliomyelitis from the world by the year 2000. "Eradication" means that there will be no wild poliovirus, not just elimination of the clinical disease. Although this goal may seem impossibly difficult, much progress has been made and the end of poliomyelitis is in sight. In 1993, nearly 80% of infants in the world were fully immunized against poliomyelitis (Figure 1). As a consequence, the number of poliomyelitis cases occurring worldwide has fallen sharply (Figure 2). Most countries of Europe are reporting no cases. In Asia, there has been a dramatic decline in the number of polio cases, particularly in China. Among the nations of the Pacific, only 6 still have endemic poliomyelitis. A number of countries in North Africa, the Middle East, Southern Africa and East Africa are reporting zero cases. Through the intensive efforts of the Pan American Health Organization, eradication of poliomyelitis from the countries of North and South America may have been achieved. Only 18 cases of laboratory-confirmed poliomyelitis due to wild poliovirus were reported in North, South and Central America and the Caribbean Islands in 1990, 9 in 1991 and 0 in 1992. WHO firmly believes that a concentrated effort will eradicate the poliomyelitis virus from the world by the year 2000.

Most of the work of poliomyelitis eradication will be performed by staff employed by the Ministries of Health of all the nations in the world with support from WHO, UNICEF, Rotary International and other agencies. However, global poliomyelitis eradication cannot be achieved without

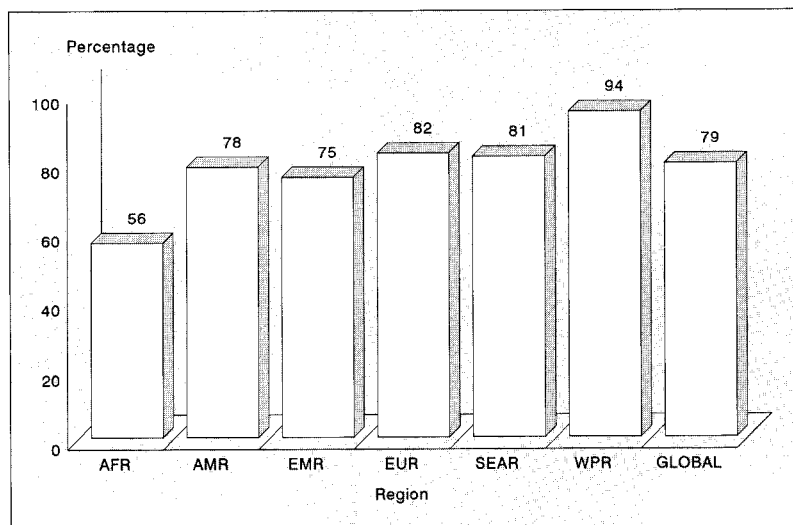


Figure 1:  
Estimated OPV3 coverage for  
children under 1 year of age,  
April 1993.

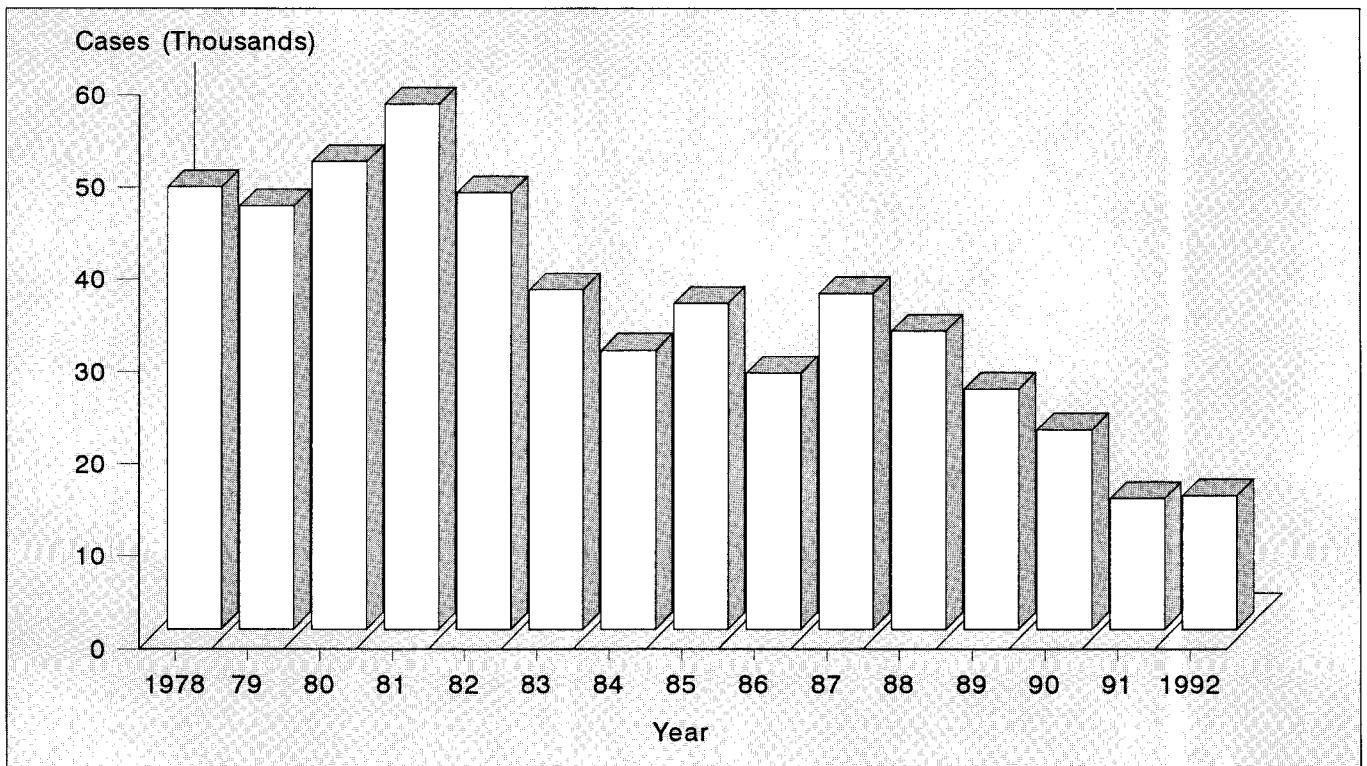


Figure 2:  
Reported Incidence of Acute  
Poliomyelitis, global, by Year.

active support and assistance of physicians, including both those in private practice and in government service. Clinicians who treat patients can play a key role in the eradication of poliomyelitis. Actions to be taken by clinicians include:

1. Considering the diagnosis of poliomyelitis for any patient they see with sudden onset of flaccid paralysis.
2. Ensuring that correct laboratory specimens are collected from patients under their care.
3. Reporting all cases of suspected poliomyelitis immediately to the public health authorities.
4. Immunizing their patients with potent polio vaccines at the recommended ages. WHO recommends the use of oral polio vaccine in polio-endemic countries.
5. Sharing their expertise in poliomyelitis and serving as experts to examine unusual cases.
6. Briefing other clinicians about poliomyelitis and the poliomyelitis eradication initiative.

This guide will provide a brief update for you on poliomyelitis, polio immunization and the eradication initiative. It is meant to stimulate your interest and to encourage your participation.

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## PART 3.

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### Poliomyelitis

#### The Virus

Poliomyelitis is caused by infection with one of the three types of poliovirus. All three types of poliovirus are capable of causing paralysis. The poliovirus has a single strand of RNA (Figure 3) and belongs to the enterovirus group which includes the echoviruses and the coxsackieviruses.

#### Epidemiology

The poliovirus infects only human beings and there is no animal reservoir. Spread of poliovirus occurs only from person to person. There is no long-term carrier state. The virus is spread primarily through the faecal-oral route, particularly in areas where sanitation is poor. In countries with a high level of sanitation, polio is transmitted principally by the respiratory route. Infants and children less than 5 years of age are most frequently affected (Figure 4). Before the introduction of polio vaccines, the disease occurred in all countries of the world. In many countries, it is a seasonal disease, occurring most frequently in the hot and humid season (Figure 5). Once a person is infected with a specific type of poliovirus, immunity to that type is lifelong. There is no cross immunity among the 3 types of poliovirus. The usual incubation period is 1 to 2 weeks for paralytic cases, but may be as long as 5 weeks.

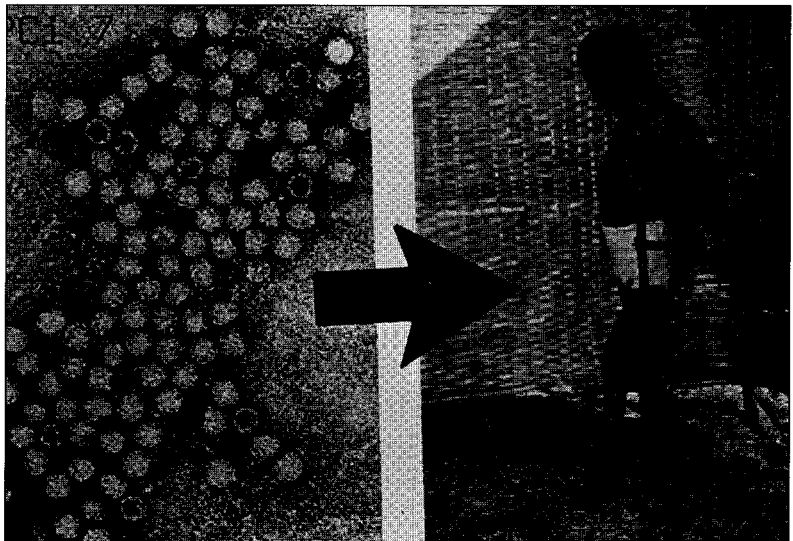
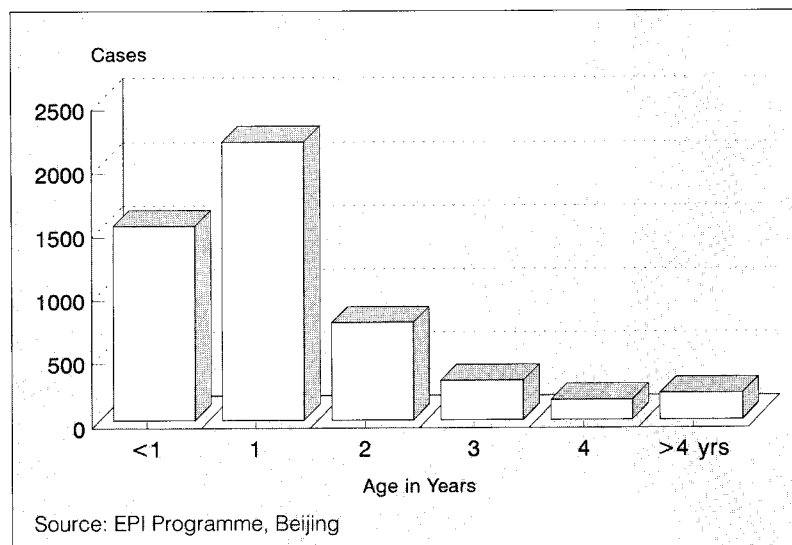


Figure 3:  
The Poliovirus,  
by electron microscopy (left).  
A victim of poliomyelitis (right).

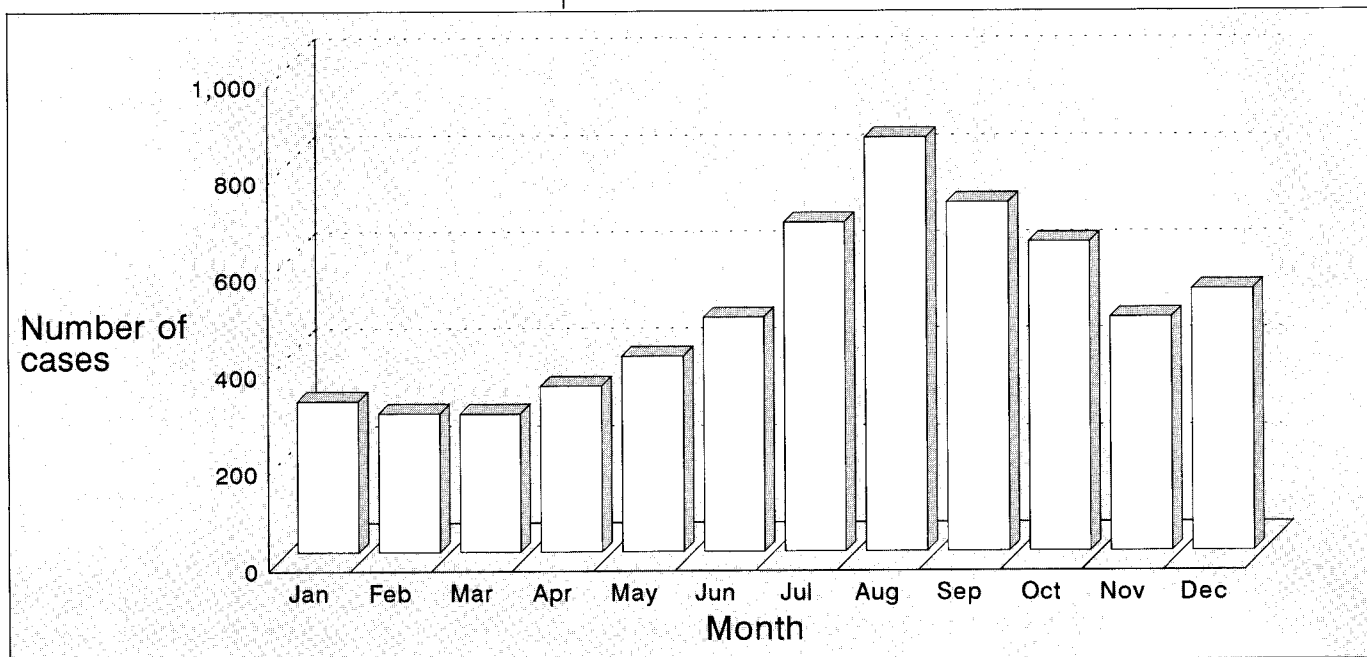
Figure 4:  
Age distribution of poliomyelitis,  
China - 1990.



### Clinical Course

When a susceptible person becomes infected with a poliovirus, the virus multiplies in the pharynx and intestines. During the next several days, the virus spreads to the regional lymph system and may also enter the blood. The virus may spread to the spinal cord and brain through the blood, or perhaps by travelling through the nerve

Figure 5:  
Seasonal variation of poliomyelitis,  
incidence, India - 1991.



fibres. Once the virus has entered the nervous system, it selectively invades the motor neurons of the spinal cord and/or brain stem. As these cells are damaged and destroyed, the denervated muscles become paralysed and, eventually, atrophy.

The clinical responses to poliovirus infection are extremely variable. In more than 90% of infected individuals, poliovirus infection is inapparent. An additional 4 to 8% of infections will result in a minor illness also known as abortive poliomyelitis and about 1% of cases will present as aseptic meningitis. Between 1 and 10 of every 1000 susceptible persons (0.1-1.0%) infected with a poliovirus will develop paralytic disease.

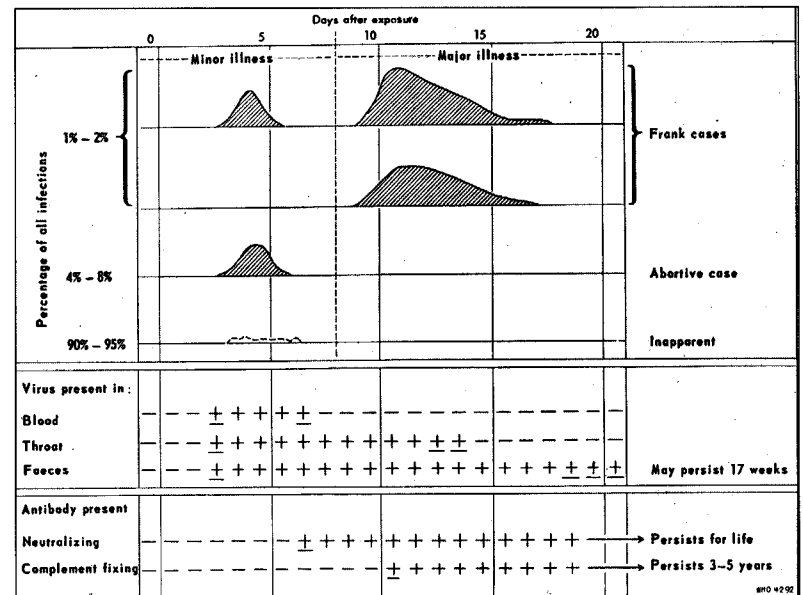
In inapparent infections, the infected person has no signs of illness resulting from the poliovirus. People with inapparent infection would not seek medical care but are capable of spreading the virus to others.

Abortive poliomyelitis is a mild illness, characterized by low grade fever, sore throat, vomiting, abdominal pain, loss of appetite and malaise. Because these symptoms are non-specific, this form of poliovirus infection cannot be distinguished from other mild, viral infections. There is no paralysis and recovery is rapid and complete.

Aseptic meningitis caused by a poliovirus cannot be distinguished on clinical grounds from aseptic meningitis caused by other viruses. The symptoms include malaise, fever, headache, muscle aches, hyperaesthesias and paraesthesias. Nausea, vomiting, diarrhoea, constipation or loss of appetite may also be present. Physical examination may reveal stiffness of the neck, particularly in the early stages of the illness. A lumbar puncture will demonstrate a moderate increase (less than 1500 per mm<sup>3</sup>) in the number of white blood cells in the cerebral spinal fluid (CSF). Early in the course of the illness, these cells may be polymorphonuclear leucocytes, but later lymphocytes will predominate. The CSF protein may be either normal or slightly elevated and CSF glucose is normal.

The typical course of paralytic poliomyelitis occurs in two phases, minor and major, sometimes separated by several days without symptoms (Figure 6). The minor phase of polio consists of fever, upper respiratory and the gastrointestinal

Figure 6:  
Schematic diagrams of the clinical and subclinical forms of poliomyelitis, showing presence of virus and antibodies in relation to the development and subsidence of the infection.  
(From Badian and Horstmann, 1965).



symptoms typical of abortive poliomyelitis. The major phase of the illness begins with muscle pain and spasms and return of the fever. This is followed by the rapid onset of flaccid paralysis, sometimes taking only a few hours, but almost always complete within 48 hours. It never progresses after more than 5 days. Tendon reflexes may disappear before muscle weakness is obvious. Paralysis affects the legs more often than the arms and is usually asymmetric. The large, proximal muscles are affected more often than the small, distal muscles. In severe cases, quadriplegia may develop with involvement of the trunk, abdominal and thoracic muscles. The paralysis of poliomyelitis is flaccid; the muscles are floppy and without tone. Reflexes are absent in the affected muscles. The sensory nerves are usually not affected; the sense of pain and touch are normal. Spinal paralytic poliomyelitis, affecting the muscles of the legs, arms or trunk, is the most common form of paralytic poliomyelitis.

Bulbar paralytic poliomyelitis is less common. In bulbar poliomyelitis, the motor neurons of the cranial nerves originating in the brain stem are affected. Bulbar poliomyelitis without simultaneous spinal poliomyelitis is rare. In bulbar polio, there may be severe respiratory insufficiency, difficulty in swallowing, eating and speaking. The risk of death from respiratory insufficiency is high in bulbar poliomyelitis.

An infrequent manifestation of poliomyelitis is encephalitis. Polioencephalitis affects infants and children more often than adults and cannot be distinguished clinically from other forms of viral encephalitis.

The risk of developing paralytic polio during an infection with the poliovirus is not the same for all persons. Pregnant women are more likely to become paralysed when infected with a poliovirus. Strenuous exercise, tonsillectomy and intramuscular injections during poliovirus infection increase the risk of developing paralysis. Paralysis is more likely to occur in the limb receiving an intramuscular injection. Tonsillectomy increases the risk of bulbar poliomyelitis during the postoperative period. Because of the increased risk of paralysis, elective surgery should be postponed during known polio outbreaks and only the most essential injections given. In countries where poliomyelitis is endemic, antibiotics, when indicated, should be given whenever possible by mouth rather than parenterally, particularly during the hot and humid season.

## **Differential Diagnosis**

Poliomyelitis should be considered in the differential diagnosis of any case of paralysis. A thorough history and physical examination should be performed plus laboratory examinations when available. The initial clinical evaluation will usually allow the clinician to exclude other causes of paralysis, particularly bacterial meningitis, injuries and cerebral palsy. Traumatic myelitis with injury to the sciatic nerve following a misplaced gluteal injection requires a careful history taking to differentiate it from provocation polio. The probability of polio is high if the patient is a child; fever is present at the onset of paralysis; the onset is sudden; and progression of the paralysis is rapid and completed within a few days. Spastic paralysis with tight muscles and increased reflexes indicates that the illness is not poliomyelitis, which is characterized by flaccid paralysis.

Poliovirus infection is only one of a number of causes of acute flaccid paralysis in children and young adults. The possibility of polio should be considered for any case of acute flaccid paralysis, even in countries where polio is thought to be absent. In countries with low polio incidence,

	POLIO	G.B.S.	TRAUMATIC NEURITIS	TRANSVERSE MYELITIS
INSTALLATION OF PARALYSIS	24 to 48 hours	from hours to ten days	from hours to four days	from hours to four days
FEVER AT ONSET	high, always present at onset of flaccid paralysis gone the following day	not common	commonly present before, during and after flaccid paralysis	rarely present
FLACCID PARALYSIS	acute, asymmetrical, principally proximal	generally acute, symmetrical and distal	asymmetrical, acute, and affecting only one limb	acute, lower limbs, symmetrical
MUSCLE TONE	reduced or absent in the affected limb	global hypotonia	reduced or absent in the affected limb	hypotonia in lower limbs
DEEP-TENDON REFLEXES	decreased to absent	globally absent	decreased to absent	absent in lower limbs
SENSATION	severe myalgia, backache	cramps, tingling, hypo-anesthesia of palms and soles	pain in gluteus, hypothermia	anesthesia of lower limbs with sensory perception
CRANIAL NERVE INVOLVEMENT	only when bulbar involvement is present	often present, low and high. Miller-Fisher Syndrome	absent	absent
RESPIRATORY INSUFFICIENCY	only when bulbar involvement is present	in severe cases, enhanced by bacterial pneumonia	absent	often thoracic, with sensory perception
AUTONOMIC SIGNS & SYMPTOMS	dysautonomia	rare	frequent blood pressure alterations, sweating, blushing and body temperature fluctuations	hypothermia in affected limb
CEREBRO-SPINAL FLUID	inflammatory	albumin-cytologic dissociation	normal	normal or mild in cells
BLADDER DYSFUNCTION	absent	sometimes	transient	never
NERVE CONDUCTION VELOCITY: THIRD WEEK	abnormal: anterior horn cell disease (normal during the first two weeks)	abnormal: demyelination	abnormal: axonal damage	normal or abnormal, no diagnostic value
EMG AT THREE WEEKS	abnormal	normal	normal	normal
SEQUELAE AT THREE MONTHS AND UP TO A YEAR	severe, asymmetrical atrophy, skeletal deformities developing later	mild	symmetrical atrophy of peroneal muscles	moderate atrophy, only in affected lower limb

Source: "The Diagnosis of Polio and Other Acute Flaccid Paralysis; A Neurological Approach"; Alcalá, H; Olivé, J-M; de Quadros, C; No. EPI/TAG/91-10. Document presented at the Ninth Meeting of the Technical Advisory Group on Vaccine-Preventable Diseases, held in Guatemala City, Guatemala, from 12 to 15 March, 1991.

Table 1:  
Criteria for the differential diagnosis of  
Poliomyelitis, Guillain-Barré Syndrome,  
Transverse Myelitis and Traumatic  
Neuritis

the diagnosis of paralytic poliomyelitis should be discarded only after appropriate viral studies have proved negative and another diagnosis has been established.

The diagnoses most often confused with paralytic poliomyelitis are the Guillain-Barré syndrome, transverse myelitis and traumatic paralysis due to sciatic nerve injury. The presentations of these four conditions are compared in Table 1. Experienced clinicians will often be able to distinguish these conditions by careful history taking and observation of the patient. However, many cases of polio have initially been diagnosed as Guillain-Barré syndrome, even by experts. Accordingly, WHO recommends that stool specimens should be tested for poliovirus on all cases of Guillain-Barré syndrome less than 5 years of age.

Wild polioviruses are not the only cause of paralytic polio. Rarely, poliomyelitis is caused by the poliovirus used in live, oral polio vaccine. In vaccine-associated polio, there is a history of administration of oral polio vaccine to the patient 6 to 30 days before paralysis or to a close contact within 6 to 60 days prior to the onset of paralysis. The virus isolated from the stool of a patient with vaccine-associated polio can be distinguished from the wild virus by sophisticated laboratory techniques. There is also a syndrome of paralysis identical to paralytic polio but caused by other enteroviruses, notably enterovirus 71. Cases of this syndrome can only be distinguished from poliomyelitis by isolating the causative virus from the stool.

## **Laboratory Diagnosis**

In countries where poliomyelitis is common and laboratory access is limited, the diagnosis of polio frequently must be made on clinical grounds alone. However, as a country approaches polio eradication and the number of cases becomes small, each case must be confirmed in the laboratory. Laboratory studies will allow differentiation of cases of acute polio from patients with flaccid paralysis due to other causes. These studies will also allow identification of cases of paralytic poliomyelitis caused by the vaccine.

Examination of the CSF in polio is not diagnostic and can only be used to support a diagnosis of poliomyelitis. The characteristic changes found on electromyography do not

distinguish paralytic poliomyelitis from paralysis caused by other enteroviruses.

Serologic studies demonstrating the development of serum antibodies to polioviruses may help confirm the diagnosis of acute polio infection. However, interpretation of the results of these tests may be difficult and requires considerable expertise. In addition, commonly available serologic tests do not distinguish wild poliovirus infection from the normal response to polio vaccination. Serologic tests, therefore, are not recommended by WHO for routine use in the diagnosis of polio cases.

**The World Health Organization currently recommends that laboratory diagnosis of poliomyelitis be done by isolation and identification of the poliovirus in the stool in specialized laboratories using cell culture techniques.**

Because excretion of the virus in the stool is variable, two stool specimens should be collected 24-48 hours apart. Stool specimens should be collected as soon as possible once the diagnosis is considered, ideally within 1 week of the onset of paralysis when the quantity of virus in the stool is highest. Stool specimens of approximately 8 grams (the size of a thumb) should be placed in a sterile glass or plastic container. If the patient cannot defecate, rectal straws may be used. Rectal straws are plastic tubes which may be inserted gently into the rectum to obtain a small stool sample. The filled straws should be placed in securely sealed tubes. After collection, stool specimens should be refrigerated to ensure that the virus is still alive when it arrives at the laboratory. Stool collection kits (including rectal straws) should be available from the national Expanded Programme on Immunization (EPI). Arrangements for transportation of specimens should be made through your EPI programme.

## **Prognosis**

The case fatality rate for poliomyelitis is low, usually less than 5%. Death is most often due to respiratory failure. For paralytic poliomyelitis, recovery depends on the extent of muscle involvement. Six weeks after the onset of illness, most of the reversible neuronal damage has disappeared. Muscles that are paralysed beyond six weeks are likely to remain permanently paralysed. Any improvement beyond

that point will be slight and will depend on hypertrophy and re-education of muscles, rather than on recovery of neuronal function.

## Management

Most cases of non-paralytic polio will not be recognized as polio. However during polio outbreaks, some patients may have symptoms compatible with non-paralytic polio. Patients presumed to have non-paralytic forms of poliomyelitis should be given symptomatic treatment with analgesics and bed rest as needed, at least until the temperature returns to normal. Strenuous exercise should be avoided for several weeks. Patients who may have a non-paralytic form of poliovirus infection should not be given any intramuscular injections.

A patient with acute flaccid paralysis should, when possible, be evaluated by a physician experienced in the diagnosis of diseases of the nervous system. Because of the risk of respiratory failure, patients with difficulty in swallowing and/or weakness of the muscles of the head, neck or trunk should be cared for in a hospital capable of providing ventilatory support. The painful spasms of acute paralytic poliomyelitis may require bed rest, treatment with analgesics or narcotics, and heat packs. It is best to mobilize the patient as soon as possible after acute pain has subsided. Physical therapy can be carried out by family members in the home and should be continued on a long-term basis. Proper positioning and exercise will maximize recovery as well as preventing deformity of the affected limbs. Long-term care of paralytic poliomyelitis patients should be supervised wherever possible by trained rehabilitation professionals. A separate manual, **Guidelines for the Prevention of Deformities in Polio**, is available from the national EPI programme.

## Vaccines

Two types of polio vaccines are available for the prevention of poliomyelitis; oral, live polio vaccine (OPV) and inactivated or killed polio vaccine (IPV). Among the advantages of OPV are that it is given by mouth; it is easy

to administer; and its cost is low. The most important advantage of OPV is that it produces intestinal immunity to the polioviruses. As a result, children immunized with OPV are unlikely to spread wild poliovirus to other children. When administered in mass campaigns, OPV can also, by stopping spread of wild poliovirus in the community, interrupt wild virus transmission. The disadvantage of OPV is that approximately 3 cases of vaccine-associated paralytic disease will occur for every 10,000,000 doses of OPV given. Cases may occur either in vaccinees or in their susceptible, close contacts. The risk appears highest following the first dose of OPV. In developing countries, three doses of OPV are 80-85% effective in preventing paralytic polio. **OPV is the vaccine recommended by the World Health Organization.**

IPV prevents paralytic poliomyelitis by producing sufficient serum antibody to prevent poliovirus from entering the nervous system via the blood stream. The major advantage of IPV is that there is no risk of vaccine-associated paralysis. The disadvantage of IPV is that it produces significantly less intestinal immunity to polioviruses. As a result, a child immunized with IPV is more likely to spread wild poliovirus to other children. IPV must also be given by injection, requiring trained personnel and additional equipment. In addition, at current prices, IPV is much more expensive than OPV.

Both OPV and IPV can be inactivated by heat, so that both must be transported and stored under refrigeration. IPV should be kept in a refrigerator at 0° to 8° C. OPV may be kept in a refrigerator for short periods, but should be frozen at -15° to -25° C if long storage periods are necessary.

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## **PART 4.**

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### **The Polio Eradication Initiative**

#### **THE ROLE OF CLINICIANS**

Because poliomyelitis is a disease only of humans and there is no other source of the virus in nature, the eradication of poliomyelitis is possible. The first step in achieving eradication is to attain high levels of immunity to the polioviruses in the population. In general, 70% to 80% of infants should be fully vaccinated against polio before a country undertakes specific polio eradication activities. Clinicians who care for infants should ensure that all their patients are immunized at the ages recommended by their national immunization programme. The clinician must also ensure that the vaccine administered is obtained from a reliable source with good refrigeration facilities, that the vaccine is kept cold during transport to the clinic and stored in the clinic at proper temperatures, and that children are given vaccine which has not passed the expiry date.

Immunization coverage rates of 70% to 80% will reduce the number of polio cases. It will be necessary to develop a surveillance system to detect every case of paralytic poliomyelitis in the country. Physicians providing medical care to polio cases represent an important component of the surveillance system. The polio eradication initiative asks that every case of acute flaccid paralysis (including Guillain-Barré syndrome) in a patient under 5 years of age, be reported immediately to the local health authorities as a suspected case of polio. Stool specimens should be collected and submitted for virus isolation on all these cases. Reporting of every case of acute flaccid paralysis will result in investigation of cases that are not caused by the poliovirus. Because the eradication initiative seeks to find every case of polio, it is better to report a case that is not polio than to risk missing a case that could be polio.

The eradication effort depends upon the use of data from the surveillance system to target immunization activities to areas where wild poliovirus is being transmitted. When a suspected case of polio is reported, a search will be initiated for other possible polio cases living nearby. Outbreak response immunization will also be conducted in the infected area. WHO's recommendation is that 2 doses of OPV be given to all children less than 5 years of age in the affected area. Even fully immunized children should be reimmunized to totally eliminate wild virus from the infected

locality. More children will be immunized by going from house to house, taking the vaccine directly to the children, than by offering vaccine at an immunization station and expecting the children to come to the station. Because OPV is given by mouth, some countries may choose to use trained, non-medical volunteers to assist in the immunization campaign.

Surveillance data are also used to identify areas of the country at high risk of persisting poliovirus transmission. These areas include those reporting polio cases in the last three years. Localized mass immunization campaigns will be conducted in these political subdivisions. Again, door-to-door delivery of vaccine for all children less than 5 years of age is recommended. Political subdivisions with low immunization coverage may also be targeted for supplemental immunization campaigns. Clinicians can assist in this phase of the eradication initiative by helping to organize immunization campaigns in their communities.

Clinicians can participate in the poliomyelitis eradication effort in one final way. Physicians are needed to serve as polio experts in their communities. Polio has become a rare disease in many areas of the world and younger physicians, in particular, may not recognize the disease. Some cases of paralysis are difficult to diagnose. Polio experts are needed to teach their colleagues about polio and to examine difficult cases. Clinicians with an interest in polio are needed to fill these roles.

For more information about the polio eradication initiative in your country, contact the Immunization Programme at your Ministry of Health.

The World Health Organization wishes to thank the governments of the following countries whose support has made the production of this document possible: Australia, China, Denmark, Netherlands, Norway. In addition, the following donors have supported the polio eradication initiative: Rotary International, UNICEF, USA, and Japan.

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